DECLARATION

I, Hironobu Kazuhara, residing at Matsugasaki 219-8, Kashiwa-shi, Chiba-ken 277, Japan, do hereby declare that I am familiar with the English and Japanese languages and that the annexed document in the English language is a full and faithful translation, prepared by me, of the certified copy of the Japanese Patent Application No. 2000-140008 filed May 12, 2000.

Dated this 8th day of July, 2003

Hironobu Kazuhara

PATENT OFFICE
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Applicant: DAINIPPON PRINTING CO., LTD.

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[Name of Document] Abstract 1
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[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION] FRAME FOR SEMICONDUCTOR DEVICE ENCAPSULATED WITH RESIN

[CLAIMS]

[Claim 1] A frame for semiconductor device encapsulated with resin comprising plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor elements are arranged on die-pads supported with suspending leads of individual lead frames, and the semiconductor elements are collectively molded, then the collectively molded semiconductor devices are cut by means of a dicing saw into individual semiconductor devices encapsulated with resin at grid-frames, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals by subjecting a half-cutting process by etching from the front or back thereof.

[Claim 2] A frame for semiconductor device encapsulated with resin comprising plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor elements are arranged on die-pads supported with suspending leads of individual lead frames, and the semiconductor elements are collectively molded, then the collectively molded semiconductor devices are cut by means of a dicing saw into individual semiconductor devices encapsulated with resin at grid-frames, wherein hollows are formed in areas corresponding to neighborhood of the roots of individual terminals.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNICAL FILED OF THE INVENTION]

The present invention belongs to a technique of a semiconductor device encapsulated with resin in which a semiconductor element is mounted on a

lead frame and the outside thereof, particularly the upper surface of the semiconductor element is encapsulated with molding resin.

[0002]

[BACKGROUND TECHNOLOGY]

In recent years, it has been required to miniaturize and thin a semiconductor product mounted on a substrate, as substrate mounting is made denser. It has been severely required for LSI to reduce the number of chips with high integration and to miniaturize and make a package lighter, and the popularization of a so-called CSP (Chip Size Package) is rapidly advancing. Particularly, in the development of thin semiconductor product with a lead frame, a semiconductor element is mounted on the lead frame and the surface of semiconductor element mounted on the lead frame is encapsulated with molding resin.

[0003]

Fig. 1 is a sectional view of one example of a semiconductor device encapsulated with resin. Fig. 2 is a plan view thereof. The semiconductor device encapsulated with resin shown in these figures is comprised of a semiconductor element 4 mounted on a die-pad 3 supported with suspending leads 2 of a lead frame 1, metallic thin wires 6 electrically connecting electrodes provided on the top face of the semiconductor element 4 with terminals 5 of the lead frame 1, respectively and an encapsulated resin 7 for encapsulating the outside region of the semiconductor element 4 including the upper side of the semiconductor element 4 and the lower side of the die-pad 3. The semiconductor device encapsulated with resin is of non-lead type in which so-called outer leads are not projected from the semiconductor device and both of inner leads and outer leads are integrated with each other as terminals 5. Further, the used lead flame 1 is subjected to a half-cutting process by etching in such a manner that the die-pad 3 is positioned higher than the terminals 5. Since such a step is formed therebetween, the

encapsulated resin 7 can be existed in the lower side of the die-pad 3 so that a thin semiconductor device can be realized even though the semiconductor device is of a non-exposed die-pad.

[0004]

Since the semiconductor element is miniature, a matrix type frame is mainly used for the above-mentioned semiconductor device encapsulated with resin of non-lead type, in which plural semiconductor devices are arranged in a direction of a width of one frame. Further, recently, from a demand for cost down, it is thought to switch over a frame of individually molding type shown in Fig. 3 to a frame of collectively molding type shown in Fig.4.

[0005]

In the frame of individually molding type, as shown in Fig. 3(A), individual molding cavities C of small size are provided separately within one frame F, and after molding, individual semiconductor devices are stamped out by metal mold so that semiconductor devices S shown in Fig. 3(B) are obtained. Namely, semiconductor elements are mounted on the die-pads of the lead frames through silver paste and the like, and after wire bonding is carried out, respective semiconductor elements are individually molded and the respective molded semiconductor elements are stamped out to form individual semiconductor devices encapsulated with resin.

[0006]

In the frame of collectively molding type, as shown in Fig. 4(A), some molding cavities C of large size are provided within one frame F, and multiple semiconductor elements are arranged in matrix within each molding cavity C, respectively, and these semiconductor devices are collectively molded, then the collectively molded semiconductor elements are cut at grid-leads L by means of a dicing saw so that a semiconductor device S shown in Fig. 4(B) is obtained. Namely, semiconductor elements are mounted on the die-pads of the lead frames through silver pastes and the like, and after wire bonding is

carried out, semiconductor elements arranged by plural members are collectively molded at a given cavity size, and then the collectively molded semiconductor elements are cut to form individual semiconductor devices by dicing.

[0007]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

As described above, in a manufacturing process of collectively molding type, plural semiconductor elements arranged in matrix are collectively molded, then the collectively molded semiconductor elements are divided into individual semiconductor devices. In this case, the collectively molded semiconductor elements are cut at grid-leads by means of a dicing saw, while terminals are cut off from grid-leads.

[0008]

Generally, in case of producing products by an etching process, parts designed to form a right angle have a roundish shape (R-shape) in a finished state where the etching process was carried out. In a frame for semiconductor device of collectively molding type, even if connecting parts of grid-leads L with terminals 5 is designed to form a right angle, products cannot be obtained as designed, etched products have R-shape as shown in Fig. 5. Further, as shown by the dotted line in Fig. 6, cut surfaces of terminals 5 of lead frame exposed in cut surface of an encapsulated resin 7 in individualized semiconductor devices formed by dividing the collectively molded semiconductor devices at cut line α by dicing becomes larger to approach to each other, in a case where larger R-shape is formed at the roots of terminals 5. Accordingly, a problem arises that accident of short circuit is caused by soldered bridge when the semiconductor device is mounted on a substrate.

[0009]

The present invention is made in view of such problems, and an object of the present invention is to provide a frame for a semiconductor device encapsulated with resin, wherein lead frames used for the semiconductor device of collectively molding type are arranged, in which accidents such as soldered bridge and the like are prevented from occurring when the semiconductor device is mounted on a substrate.

[0010]

[MEANS FOR SOLVING THE PROBLEMS]

In order to achieve the above-mentioned object, a first type of frame for a semiconductor device encapsulated with resin of the present invention is characterized in comprising plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor elements are arranged on die-pads supported with suspending leads of individual lead frames, and the semiconductor elements are collectively molded, then the collectively molded semiconductor devices are cut by means of a dicing saw into individual semiconductor devices encapsulated with resin at grid-frames, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals by subjecting a half-cutting process by etching from the front or back thereof.

[0011]

Further, a second type of frame for semiconductor device encapsulated with resin of the present invention is characterized in comprising plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor elements are arranged on die-pads supported with suspending leads of individual lead frames, and the semiconductor elements are collectively molded, then the collectively molded semiconductor devices are cut by means of a dicing saw into individual semiconductor devices encapsulated with resin

at grid-frames, wherein hollows are formed in areas corresponding to neighborhood of the roots of individual terminals.

[0012]

[EMBODIMENTS FOR CARRYING OUT THE INVENTION]

Then, embodiments of the present inventions are explained with reference to figures. Fig. 7 is a plan view showing one example of first type of a frame for semiconductor device encapsulated with resin of the present invention, Fig. 8 is a partial enlarged plan view of the frame shown in Fig. 7, and Fig. 9 is a sectional view taken on line A-A in Fig.8.

[0013]

In these figures, F designates one metal frame for lead frames, in which lead frames 10 are arranged in matrix of 3×4 through grid-leads L. The grid-leads L connect terminals 5 of adjacent lead frames 10 with each other. As shown in Figs. 8 and 9, areas including neighborhood of the roots of the terminals 5 connected with grid-leads L are provided with thin parts 11 which are formed by half-etching from the surface, and the thin parts 11 are formed to the outside of cut line α cut by means of the dicing saw. Therefore, even if R-shapes are generated at the roots of the terminals 5, R becomes smaller by an extent that the thickness is decreased, as compared with that which is not half-etched, and hence sectional area of terminals 5 is not increased at the cut lines α.

[0014]

Procedures for producing semiconductor device encapsulated with resin using the frame F is as follows. First, semiconductor elements are mounted on die-pads 3 of the respective lead frames 10 of the frame F through silver pastes and wire bonding is made between terminals 5 and electrodes provided on the top face of semiconductor elements, then twelve semiconductor elements are collectively molded at a given cavity size, and thereafter the collectively molded semiconductor elements are cut at the

dicing line α by means of a dicing saw in such a manner that terminals 5 of individual lead frames are left, by which the collectively molded semiconductor elements are divided into individual semiconductor devices encapsulated with resin.

[0015]

In the semiconductor device encapsulated with resin thus individually produced, area of terminals 5 exposed in cut surface of encapsulated resin cannot be increased, and intervals between adjacent terminals 5 are kept sufficient, and hence accidents such as soldered bridge, and the like do not occur when the semiconductor device is mounted on a substrate.

[0016]

In the above-mentioned example, although the thin parts 11 are formed on the front side at neighborhood of the roots of terminals connected with grid leads, even if thin parts are formed on the backside by half-etching from the backside, the same effect can be obtained.

[0017]

Fig. 10 is a partial enlarged plan view of example of a second type of frame for semiconductor device encapsulated with resin of the present invention.

[0018]

The frame has a structure to provide hollows 12 having angular shape at neighborhood of the roots of terminals 5, and the hollows 12 are formed to the outside of cut line α. If the hollows 12 having such a shape are provided at the roots of the terminals 5, problems caused by R-shape generated at the roots of terminals when etching are irrelevant, and hence sectional areas of the terminals 5 at the cut line α are not increased.

[0019]

Fig. 11 is a partial enlarged plan view showing another example of the second type of frame for semiconductor device encapsulated with resin of the present invention.

[0020]

The frame has a structure to provide round hollows 12 in the neighborhood of the roots of terminals 5, and the hollows 12 are formed in such a manner that the hollows are cut into a part of grid-leads L from cut line α along which the frame is cut by a dicing saw. In case where the hollows 12 having such a shape are provided at the roots of terminals 5, problems caused by R-shape generated at the roots of terminals when etching become irrelevant, and sectional areas of terminals 5 at the cut line α are not increased.

[0021]

In case of the semiconductor device encapsulated with resin produced using a second type of frame as shown in Figs. 10 and 11, sectional areas of terminals exposed at cut surface of encapsulated resin are not increased, and intervals between adjacent terminals 5 are sufficiently kept, so that accidents such as soldered bridge and the like do not occur when the semiconductor device is mounted on a substrate.

[0022]

[EFFECT OF THE INVENTION]

As above-mentioned, since the present invention is structured that the frame for semiconductor device encapsulated with resin of the present invention comprises plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor elements are arranged on die-pads supported with suspending leads of individual lead frames, and the semiconductor elements are collectively molded with molding compound, then the collectively molded semiconductor devices are cut by a dicing saw into individual semiconductor

devices encapsulated with resin at grid-leads, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals by subjecting a half-cutting process by etching from the front or back thereof, or hollows are formed in areas corresponding to neighborhood of the roots of individual terminals, the sectional area of terminals at the cut surfaces when dicing is not increased so that intervals between adjacent terminals are sufficiently kept, and hence accidents such as soldered bridge and the like do not occur when the semiconductor device is mounted on a substrate.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

A sectional view showing one example of a semiconductor device encapsulated with resin.

[Fig. 2]

A plan view of the semiconductor device encapsulated with resin shown in Fig. 1.

[Fig. 3]

An explanatory view of a frame of an individually molding type.

[Fig. 4]

An explanatory view of a collectively molding type.

[Fig. 5]

An explanatory view of an R-shape generated by etching.

[Fig. 6]

An explanatory view showing terminals exposed in cut surface.

[Fig. 7]

A plan view of one example of a first type of frame for a semiconductor device encapsulated with resin of the present invention.

[Fig. 8]

A partial enlarged plan view of the frame shown in Fig.7.

[Fig. 9]

A sectional view taken on line A-A in Fig. 8.

[Fig. 10]

A partial enlarged plan view of one example of a second type of frame for a semiconductor device encapsulated with resin of the present invention.

[Fig. 11]

A partial enlarged plan view of another example of the second type of frame for semiconductor device encapsulated with resin of the present invention.

[Reference of Numerals]

1 lead frame
2 lead
3 die-pad
4 semiconductor element
5 terminals
6 metallic thin line
7 encapsulated resin
10 lead frame
C molding cavity
F frame
L grid-lead
S semiconductor device
α cut line

[NAME OF DOCUMENT] ABSTRACT

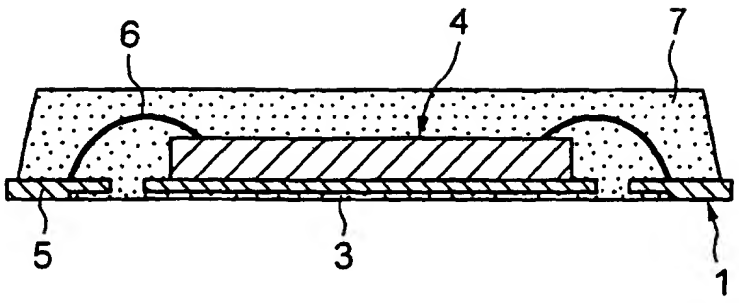
[SUMMARY]

[PURPOSE] A frame in which lead frames used for a semiconductor device of collectively molding type are arranged, in which accidents such as soldered bridge and the like are prevented from occurring when the semiconductor device is mounted on a substrate

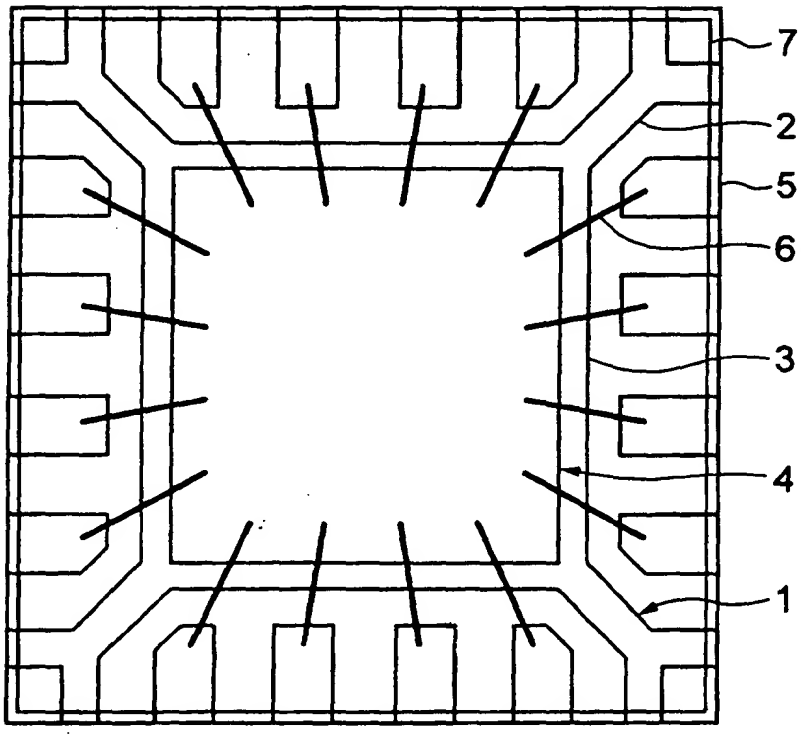
[CONSTITUTION] Respective semiconductor elements are mounted on die-pads 3 supported with suspending leads 2 of individual lead frames 10, the semiconductor elements are collectively molded, and the collectively molded semiconductor elements are cut by a dicing saw into individual semiconductor devices encapsulated with resin at a grid-lead L, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals by subjecting a half-cutting process by etching from the front or back thereof, or hollows are formed in areas corresponding to the neighborhood of the roots of individual terminals 5. Accordingly, it is inhibited that increased sectional area of terminals is formed, so that intervals between adjacent terminals 5 are sufficiently kept. Accordingly, accidents such as soldered bridge and the like do not occur when the semiconductor device is mounted on a substrate.

[SELECTED DRAWING] Fig. 7

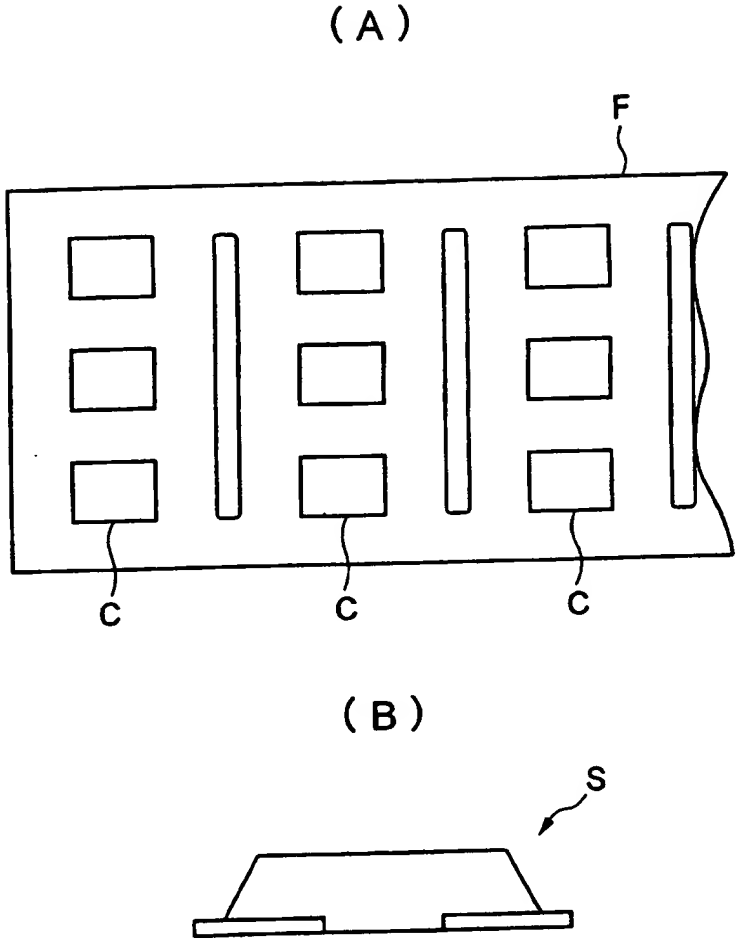
[Name of document] Drawing
[Fig. 1]



[Fig. 2]

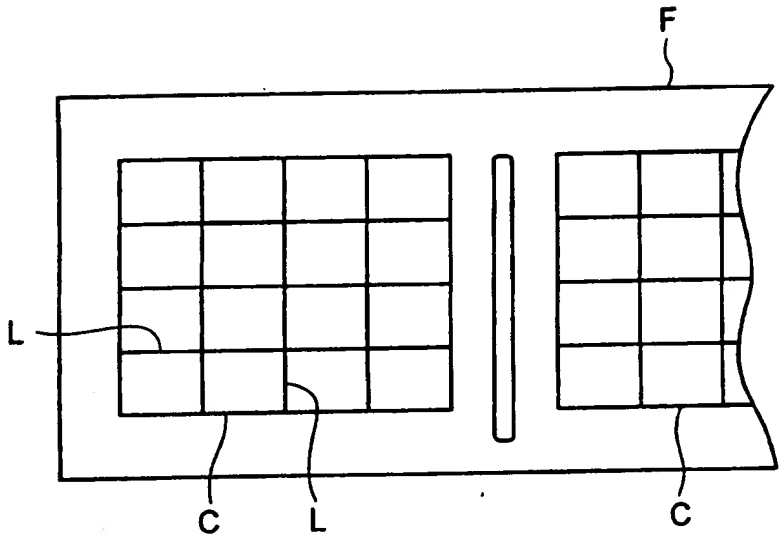


[Fig. 3]



[Fig. 4]

(A)



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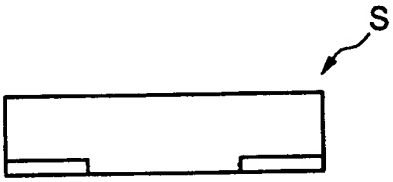
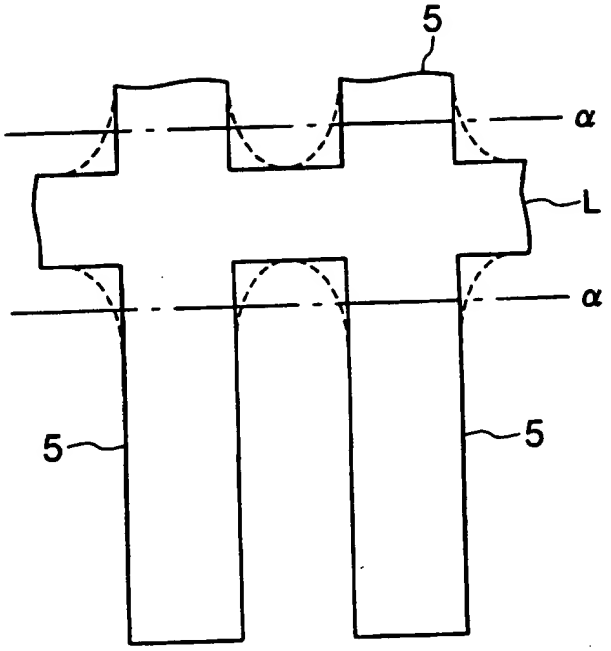
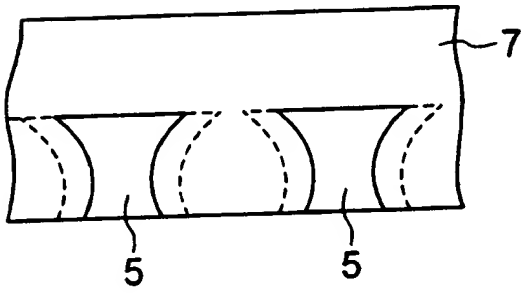


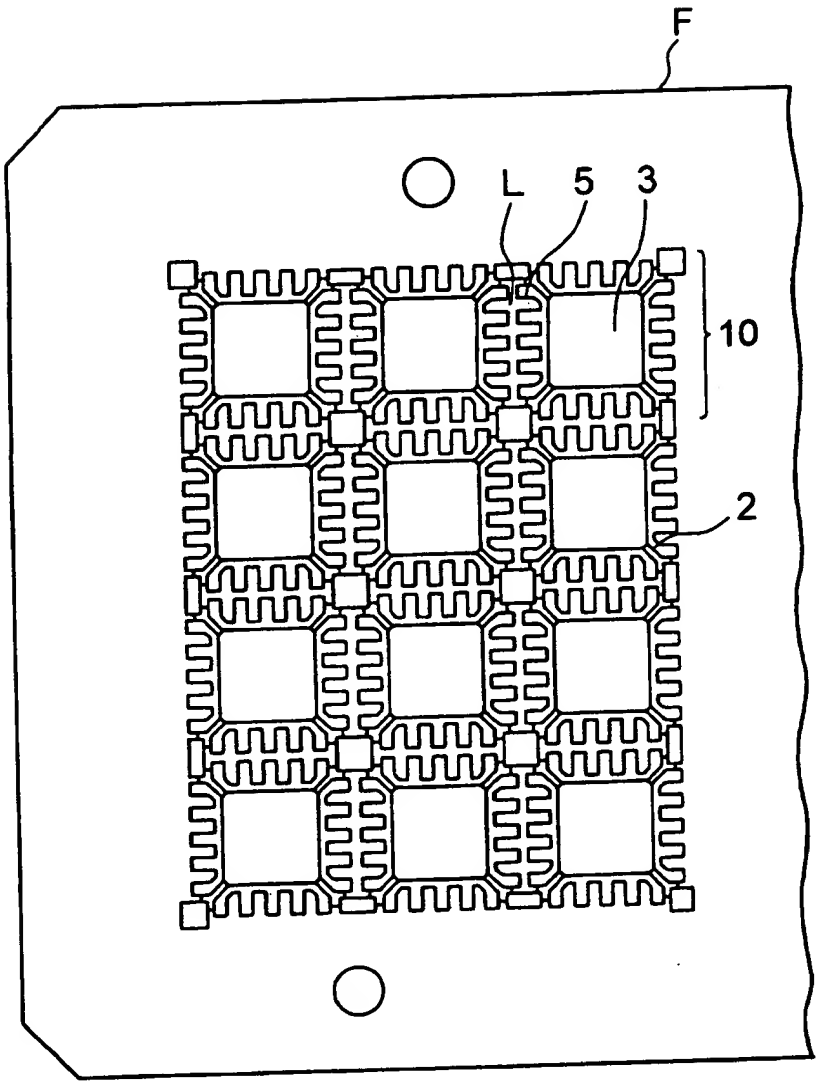
[Fig. 5]



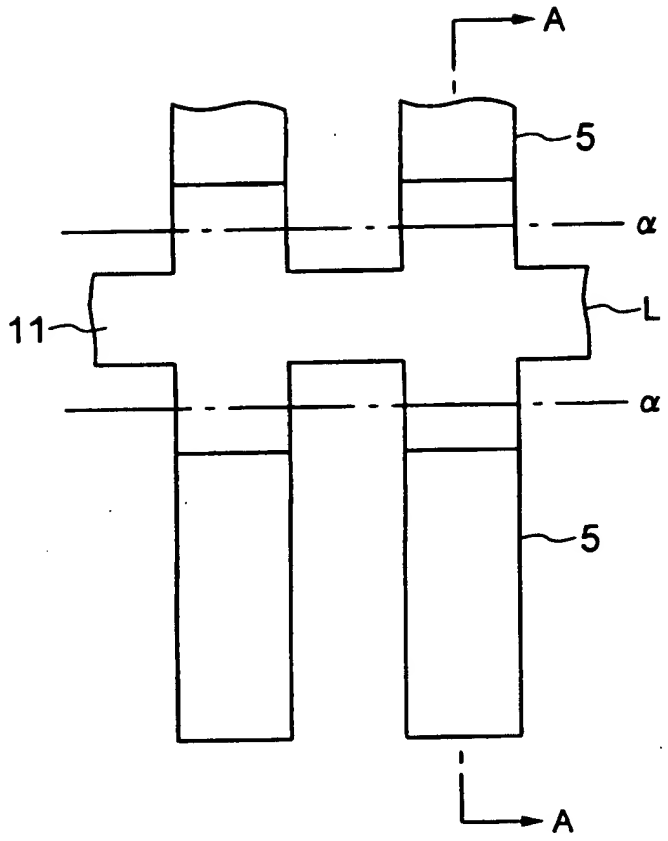
[Fig. 6]



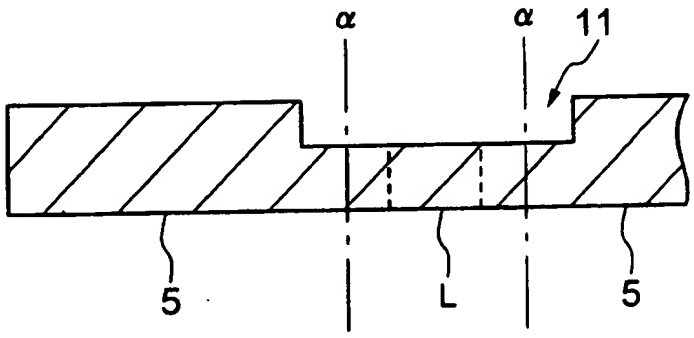
[Fig. 7]



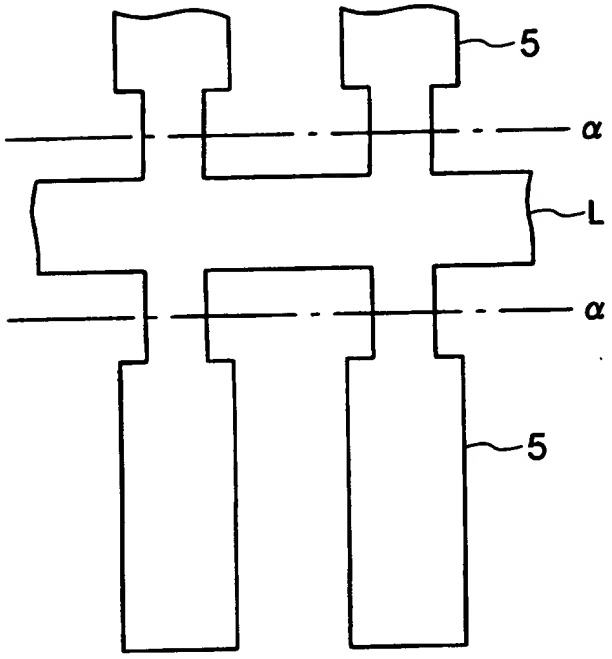
[Fig. 8]



[Fig. 9]



[Fig. 10]



[Fig. 11]